

Accelerator Systems Division Highlights Ending December 5, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) A LANL representative was at ORNL to help with the installation of the 5-MW klystron for CCL Module-1. (2) We received the second 5 MW klystron from Thales and are in the processes of installing it in the 805 MHz test stand at LANL. (3) LANL reps are scheduled to witness factory acceptance tests of the fourth 5-MW klystron next week at Thales. (4) Two factory accepted 550-kW Thales klystrons for the SC linac (S/Ns 2 and 6) are enroute from Thales and are expected to arrive next week. A LANL rep is at Thales this week to witness the FAT of the next two SCL tubes. Tests of the first one were satisfactorily completed. Tests on the second one begin on Saturday. (5) Site acceptance tests are underway on the CPI SCL klystron that failed the vacuum test (S/N 10) Electrical tests are complete and the vacuum hold test is underway. (6) We confirmed with the SCL transmitter manufacturer which refits will be done this month by LANL and ORNL personnel at ORNL. (7) We completed 14 transmitter and klystron testing related interim work document (IWD) documents and submitted them for approval. (8) We continued to work with ORNL personnel on the startup checklist for the SNS SCL transmitters.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) The production hv converter modulator (HVCN) operated satisfactorily to support klystron testing. (2) After ~750 hours at full voltage and average power and ~ 4,000 total hours, we have pulled the prototype HVCN out of service for inspection. All assemblies generally seem to be problem free. Modest carbonization was observed on a few small spots on the rectifier racks and lid. The prototype is built in a smaller tank than the production unit; there seems to be some slight carbonization on a lid angle bracket that is unique to the prototype design. This angle bracket is directly above all three rectifier racks. (3) We are rebuilding the prototype switch plate assemblies with improved IGBT bypass capacitors. (4) We continued work on analysis of IGBT switching losses and failures. (5) We reviewed and approved the 20 kHz and 40 kHz harmonic trap assembly print package. Capacitors for the assembly were ordered from General Atomics Energy Products.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) The final 4 (of 24) SNS electromagnetic dipole (EMD) drift tubes (1-52, 1-55, 1-58, and 2-36) were shipped to ORNL. (2) Six beam position monitor (BPM) drift tubes (#2-9, 3-2, 5-1, 5-7, 6-3, 6-9) were shipped to ORNL. Eight (of ten) have been shipped. We are working on the final two (#2-3 and 3-8, see below). (3) Twenty-four tank-2 drift tubes are at the copper plater. Deliveries to CMI should begin on 12/8 for final processing. The remaining drift tubes except for 2-27 & 2-30 (see below) will be delivered to the plater on Sat 12/6. (4) The remaining 2 intertank beam boxes are at LANL for leak checking. (5) Three RF grills were delivered to ORNL. (5) Tank-5 top hats and manifolds were shipped to ORNL.

Issues and Concerns: To date, 165 of the 210 drift tubes have been shipped to ORNL. The remaining 45 are nearing completion with delivery scheduled in approximately 2 weeks. To meet schedule, we are devoting special attention to 6 drift tubes: (1) Two BPM Drift Tubes

ASD/JLAB: Cold Linac

In the past three weeks, one cavity has been qualified and one has failed qualification. The failure and low testing rate are attributed primarily to problems with the High Pressure Rinse system: several failures of the pump, leading to oil contamination of the filter and the balance of the high-pressure piping; failure of the bearings under the rotating table on which the cavity rests; and contamination of the optics of the liquid particulate monitor. A new pump and motor have been installed and aligned, and the new unit is running significantly cooler than the old one did. New, more robust turntable bearings have been acquired and installed. The liquid particulate monitor optics has been cleaned and the unit has been recalibrated. The system has been in routine use this week. Water quality is excellent once again.

The helium leak into the insulation vacuum in cryomodule M-5 was identified as arising at an instrumentation feedthrough in an end can. The leak has been repaired.

Testing of the M-6 cryomodule is complete. All cavities exceeded specifications for gradient and Q_0 . It is being warmed up in preparation for removal from the CMTF. Prior to shipment, a helium leak into the insulation vacuum, probably arising at an instrumentation feedthrough, as was observed in M-5, will be repaired.

Assembly of the M-7 cryomodule is complete. The module will be installed in the CMTF and cooled down next week.

The M-8 cavity string has been turned over for cryomodule assembly, which is underway.

Three cavities are qualified for the M-9 cavity string. It will be assembled next week.

Late-breaking news: MB-31 qualified this afternoon!

ASD/BNL: Ring

BNL/SNS staff continued preparation for next Monday's Review with the SNS Project Office on FY04 and FY05 funding that includes BA, BAC, work packages and schedules.

In our weekly teleconference calls with vendors:

- NETC reported the shipment of four (4) 27CD30 magnets to SNS/OR. They plan to ship the last three production magnets to OR by mid December.
- Alpha Magnets shipped Chicane #1 to BNL on November 26 along with the repaired 41CDM30 (last one).
- SDMS – beam tubes for Ring collimators #2 and #3 have been NiT coated by the BNL/SNS Vacuum Group. They are being prepared for airfreight shipment to SDMS for final assembly.
- Tesla is on schedule to ship their last eight (8) production 21Q40 magnets to SNS/OR on December 15.

M. Hemmer and R. Lambiase continue to support ASD on creating a database for the naming convention of Ring magnets and power supplies.

BNML/SNS technicians are working on the next two half-cells, scheduled for shipment to SNS/OR in late December. Survey alignment work on these two assemblies has been slowed due to manpower reductions and RHIC start-up demands.

Magnetic Measurements: 30Q58 - transfer function measurements are underway. Our plan is to measure all twelve within the next two weeks to determine the correction and/or sorting strategy to be implemented.

The half-cell lifting fixture has been fabricated. Engineers are waiting approval by the BNL Safety Group for load testing.

BNL travel that is planned for next week:

- IE Power for final acceptance of two Injection Bump Power Supplies.
- Ranor, Inc. for pre-production meeting on R2 and R3 collimator outer shielding.
- NETC for pre-delivery inspection of the Injection Dump Septum magnets.
- Oak Ridge for design meeting on RTBT radiation hardened quads and interface.

Controls

A Project Office Review of FY '04 work packages for WBS 1.9 was held this week. The result was a number of action items and considerably less BA.

Communications cabling for the SCL medium beta area is divided into 3 installation packages, one for each grouping of racks. The installation of cables for the first group of racks is in progress. The installation design for the second group of racks was released this week and installation started. (Some of these cables are required to support SCL ME1 operations next week).

Block diagram and cable pull lists were generated for foil and scraper controls, and for SCL vacuum cryomodules 5-8. Cable pull lists for the collimator cooling water skids were also generated.

Noise studies for the Differential Beam Current Monitor (DBCM) continued this week and appear to suggest the possible need for a new or redesigned DBCM in the future.

All 80 PMC modules for MPS systems have been checked and all have passed acceptance tests. Initial reports of bad boards were actually due to improperly seated hardware.

At LANL, testing of the Residual Gas Analyzer (RGA) software RGA showed that software from the manufacturer (VTI) showed the same problem that our driver experiences. An upgrade from VTI does not show the problem after 48 hours.

A priority activity at LANL is development of a new version of the archiver that is intended to address a number of problems being experienced at SNS and elsewhere. This is a development task expected to last some four months and involves several programmers. Goals include the ability to render 1K samples from 3 signals from any point in 4 seconds, and the availability to support a number of languages. The archive engine is being reorganized to take advantage of the multi-threading that is now in the EPICS v3.14 client in support of the conversion to 3.14. This should simplify the code, make it easier to extend for new archive methods, and run faster. Good progress is being made, and early benchmarks should be available before Christmas.

The RCCS, QMCS, Vacuum, Power Supply, and RF Linac Control Systems are all proceeding on schedule. The RF on the SCL scheduled for next week will be supported remotely. It has previously been checked out at the site. Reviews were held at LANL on the Beckhoff and ControlLogix drivers. Some changes will be made to the Beckhoff driver to make the diagnostic information more available.

The Yokogawa EPICS software has been checked into ORNL CVS from BNL, and is considered complete at this time. Documentation is incomplete, but is under development. Yokogawa units have been deployed at the Power Supply vendor and are being used for acceptance testing of injection kicker power supplies.

The first pass at converting the HPRF ladder logic from PLC-5 to ControlLogix was successful at BNL. At the same time, block transfer reads and writes were demonstrated using Flex I/O from the ControlLogix PLC. This is necessary for interfacing remote HPRF equipment.

Installation

Craft Snapshot 11/18/03

ASD craft workers	54.0
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
Less WBS 1.9, 1.2 etc	5.0
Less absent	2.0
TOTAL AMSI WORKERS	61.0
TOTAL TO ASD/ORNL DB WP	47.0

Most drift tubes, except DTL 2, are now on hand from LANL. DTL 2 drift tubes are expected before Christmas. With this development, installation planning has re-emphasized that the top ASD short term priority is DTL 1, 2, & 3 installed and ready for ARR/Commissioning by March 15, 2003. This is an ORNL Fee Award Milestone.

A lessons learned meeting was held by the PO/HR/ASD on the SNS Research Mechanic program. The program has been successfully established with the selection and training of the first two individuals. The next step in the program will be to hire two more Research Mechanics into ASD in the late spring/early summer.

As of Nov, ASD installation is 42 % complete overall and 55.39 % on DB Labor. The last two months have shown consistent progress in both the total percent complete (1.9 /month) and craft percent complete (2.1 / month).

Operations Group

Working on Training for the next operating period.

Analyzed equipment performance data from the run.

Looked at a proposal for involvement in the ORNL HBCU Summer Program.

Worked on implementation of DataStream

We are ready to roll out automated Emergency Shutdown Procedures Electronic Checklist, formed from the OPM Emergency Shutdown Procedures, drops completed form into e_log. We want to extend this to SOP Turn-On and Turn-Off procedures.

Re-Evaluated beam enclosures for Commissioning

Worked on fallout from RER

Working on water issues from CLO

Holding tanks eliminated, sanitary sewer disposal limits, evaluate case-by case. Rely on carboys for waste chemical disposal

Accelerator Physics

Work is proceeding in the Applications Programming team to construct a Machine Snapshot Service. This service would take snapshots of sets of PVs on an "on-demand" basis and store them in the database. This will be extremely useful for grabbing machine conditions when a particular measurement has been performed. The service will also allow logging of e.g. beam trajectories, sets of profile data etc either at regular time intervals or on demand.

The Aps team is also building a set of optimization algorithms for use in general fitting needs.

Efforts to understand MEBT optics data acquired during the last run continue. Using wire scanner profile data in the MEBT and D-plate, we are trying to determine the MEBT input Twiss parameters and perform a comparison before and after the RFQ detuning event.

Global database population work is continuing. After iterating with M. Hemmer at BNL, we have agreed on proper names for beamline devices and associated power supplies, and these device tables are being loaded into the global database. Associated global coordinates are now being compiled, as is polarity information.

A transfer line Twiss and emittance measurement algorithm has been written by V. Danilov based on code in use at PSR. P. Chu is casting the code into the XAL framework and preparing the user interface.

Preliminary magnetic field measurements in the SCL tunnel indicate that the earth's magnetic field is the dominant component in the linac where empty no Cryomodule is installed. Around installed Cryomodules, the field is distorted and fields as high as 2 Gauss are observed. A test plan is being prepared to systematically map empty spaces and later observe the effect of installed components.

The CM data analysis Group has met to evaluate the possible impact of the results from Jefferson Lab. It will obtain more detailed data to determine the possibility of running cavities near or above the design gradient, in case HOM filter characteristics should change during operation.

Estimates from F. Gallmaier show higher than expected radiation levels in the ring tunnel due to neutrons streaming back from the injection dump. Assuming 200 kW of beam power on the dump, while the beam is on the dose rate at the beam tunnel wall is predicted to be 16,000 rem/h, due to neutrons, including a quality factor of 10. There is also a gamma dose rate of 320 rem/h. Even with the lower beam power (about 50 kW) to the dump during nominal operations, this is still more radiation than we expect from the ring itself, thus complicating the interpretation of the loss monitor system. We have begun to investigate methods to mitigate the neutron dose rate, such as adding

polyethylene to the beam tunnel wall, adding a collimator to the beam dump vacuum pipe, and changing to an aluminum beam pipe. A rule of thumb is that after 4 h of cool down the dose rate at 30 cm will drop by about a factor of 1,000 -- maybe a little more. There is also a straight line of view from the RTBT tunnel to the neutron target, so we expect similar issues in this area of the facility.

The injection dump will function best if the beam is steered to the center of the dump. It is therefore desirable to have some additional steering power in the injection beam line. Thanks to an excellent idea from BNL, this can be easily accomplished by configuring the skew quadrupole windings on the 41CDM30 magnet to work together with the dipole windings, and this is now our plan.

Work continues on the physics applications needed for ring commissioning. We've written Jython code to determine the rms emittance in the HEBT beam line from wire scanner profiles, and we are now incorporating this code into the controls framework. We've also started work on the loss monitor application.

Ion Source Group

Measuring the distance between the ion source and the LEBT revealed that we were lacking a required spacer ring on the Hot Spare Stand. This explains the high radiation levels and difficulties when conditioning the new LEBT a few weeks ago. After extensive and detailed PROJECT-WISE searches failed to produce a drawing, a spacer ring was designed, fabricated, and installed.

The ion source and LEBT on the Hot Spare Stand have been aligned with the mock RFQ entrance aperture using the recently installed positioning system. The position was adjusted until the LEBT alignment fixture centered with the mock RFQ entrance aperture.

The new positioning system features permanently installed dial gauges to track the position of the source and LEBT with respect to the mock RFQ entrance aperture. The gauges showed the IS and LEBT to move roughly 0.01 mm while pumping down, not a significant issue. The dial gauges, however, will allow testing beam based alignment before implementing a similar system on the Front End.

Survey and Alignment

This week, the Survey and Alignment group has been assisting with CCL 1 alignment. First, we laid out positions of the stand's bottom plate. Upon installation of the plates and stands, we set the elevation of CCL1 stand. Second, after the spacer shims were installed between the bottom plate and the stand, the elevation of the structure was re-verified.

Fiducialized twelve DTL drift tube magnets.

Fiducialized two additional HEBT 21Q40 magnets. Additionally, we are in the process of installing/aligning a complete 21Q40 assembly into the HEBT beam line.

We verified the location of the electrical break in HEBT tunnel floor.

Set the momentum collimator base plate to proper elevation.

The Survey and Alignment group has started the chopper cavity as-builts along with the layout of the beam lines for the Target and Instrument group.

We have been called upon several times this week for meetings with the Target/Instrument group on alignment issues concerning beam line component alignment and shutter insert alignments.

Survey & Alignment continued deformation monitoring in several areas of the site:

1. Monitoring of the footings for the Helium storage tanks revealed relatively uniform settlement (averaging about 2 mm) in the last 5 months. No unusual settlement was found around the existing cracks. Some small new cracks were noted.
2. Monitoring of the Klystron Gallery floor shows very little change over the last 7 months. Settlement of the floor along the centerline of the entire gallery averaged 0.5 mm. Settlement of the floor along the north wall was consistently larger than the corresponding centerline settlement, averaging 0.9 mm.
3. RTBT floor monitoring showed the largest deformation thus far for a one-month interval: 19 mm by the RTBT / Target building interface. The contractor stated that there is currently 5.5 feet of fill on top of the tunnel at this location. The tunnel floor is now 4.1 inches (105 mm) below design elevation here.

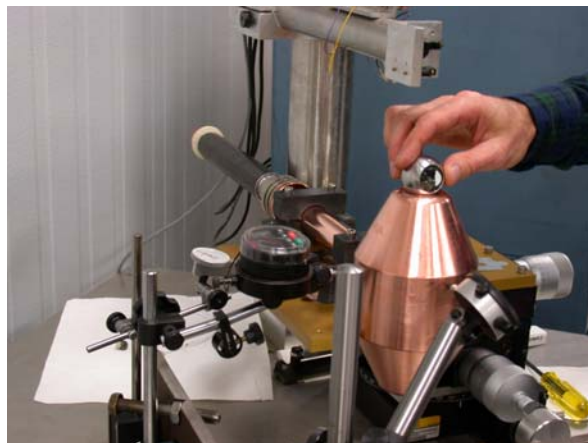
Mechanical Group

The remaining six DT's for DTL-4 (4 EMD and 2 BPM DT's) have been received at ORNL. In house testing is being performed in preparation for installation and alignment that will begin later this week. Following alignment, tuning will begin which is expected to be complete by the end of December.

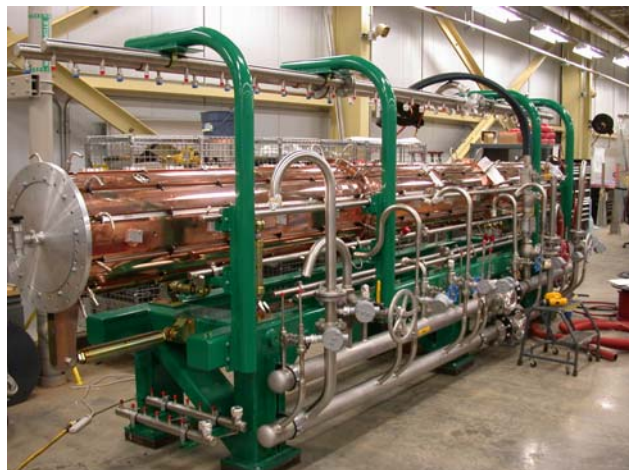
All DTL-5 DT's that are in house have been processed and are ready for installation. This activity will begin later this month.

Fiducialization, magnet mapping, and leak testing of DT's for DTL-3 and DTL-6 are currently in progress. DTL-3 DT's are the priority and installation of these DT's is expected to begin in mid December.

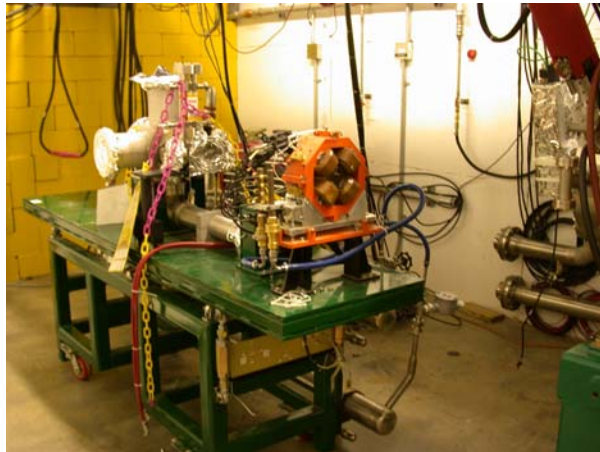
We have received and are processing 16 EMD and 2 BPM drift tubes. Once processed, we will be able to finish drift tube installation on DTL4.



The water headers have been assembled onto DTL5 and hose installation has begun.



The disassembly of the D-plate which was used for DTL1 commissioning is nearly complete.



The CCL-1 support frame has been leveled and the first two segments set in place. The remaining 10 segments will be set in place next week.



CCL-1 Support Frame Leveling



CCL-1 Segment 1 in the Tunnel

Tuning of the bottom coupling cavities is proceeding in the tunnel. The first two segments have been tuned.



CCL-1 Segment 1 Tuning in the Tunnel

Ring Systems Installation

- The HEBT momentum collimator baseplate was aligned and grouted
- The 1st HEBT 21Q40 Magnet Assembly #QH14 was installed for S&A.
- Installation of the DC cable pulling from the Ring Service building to the tunnel continued.

Water Systems Installation

- Installation of piping from SCL ME-02, TRCC-03 cart to the SCL klystrons continued
- Installation of DI manifolds to the CCL 1, 2, 3 powers supplies were installed.
- Fabrication of the QMCS piping manifold in the Linac was resumed.

Magnet Task

This week we have mapped six DTL EMD's.

We mapped two 21Q40 HEBT Quads.

We finished assembly of a 21Q40/27CD30/Beam Pipe which was successfully installed into the HEBT Beam Line.

I also traveled to Milhous Co. to check on progress of the CCL Quad rework and the status of the SRF 8Q35 production. Milhous will send the first reworked CCL Quad this week and perhaps send the first 8Q35 next week.

Electrical Group

Continue testing corrector supplies – 12 tested this week.

Started testing SCL Quad supplies – testing the software upgrade supplied by manufacturer that eliminates the inrush current problem.

Completed 2/4 of ring arc magnet cabling – these arcs are now ready for 1/2 cell installation.

HPRF

Installation of all CCL HVCM modulator tanks is now complete. We initiated checkout of the CCL-ME2 unit this week. CCL-ME3 and -ME4 are awaiting installation of their IGBT Switch Plate Assemblies and completion of the crafts' work. We began pre-installation preparation of SCL-ME2.

We have been working with Ztec, Inc., to modify the DSP and FPGA code in the control chassis to change the start pulse configuration for the SCL modulators. These changes were based on simulations performed by a LANL consultant. We will be implementing the changes on the SCL-ME1 modulator next week and verifying performance. We expect to be ready to operate the modulator the week of 15Dec03.

We performed another series of HVCM EM noise measurements on DTL-ME3, and repeated those measurements after implementation of several enhancements recommended by various experts. Those results will be published in a report.

We began design of a pulser for the HYBRIS ion source development at LBNL.

Completed cable pulls and termination of SCL-1 transmitter.

SCL-1 waveguide flanges have been torqued to spec.

208 3-phase AC power applied to SCL-1 transmitter 12-5-03.

SCL 1 & 2 HV tanks cleaned and filled with FR-3 high dielectric oil.

SCL-2 cables have been pulled, terminations 80% complete.

Transmitter start-up procedure completed with LANL.

Pressure tested Thales 5MW tube body water circuit to 155 PSI – ok.

Mounted first 5 MW tube on HV tank. Dave Warner from LANL supported the effort.

Collector shielding frame erected. Klystron output waveguide secured. SF6 windows arrived.

Mounting of lead x-ray shielding panels postponed until better weather (outside crane).

Checked tube vacuum integrity: good.

MEBT circulators on order. This will allow full reflected power from the MEBT bunchers without disturbing the high power amplifiers. Air vents added on rack tops to improve cooling.

Alex Zaltsman visited from BNL, witnessed vacuum integrity check and resonance measurement of ring RF bunching cavity located in the RFTF. Both good.

LLRF

Cryosystem Group

The warm helium compressors were started to perform the factory acceptance 168 hour tests. The leak rate test and the contamination tests were performed and the results were in excess of the specifications. However, problems with the second stage oil relief valves prevented us from completing the factory acceptance tests. It was determined that the oil relief valves of the second stage compressors were bypassing oil causing the compressor cooling loop to be starved of coolant. Oil is injected into the compressor during the compression cycle and acts as a coolant for the helium. Because of this problem the oil cooling circuits on the second stage compressors could not meet specification. Also during the test it was noted that the oil coolers on the compressor skids were also not meeting specification. The tests were terminated until these problems can be resolved.

No work was performed on the shield leak repair. All the resources were used to perform the warm helium compressor tests. Work will resume on this repair next week.

No work was performed in the fabrication shop this week. All the resources were used to perform the warm helium compressor tests. Work will resume starting next week.

Beam Diagnostics